

Vector Matrix Constant



How-to Guide

Vector, Matrix, Constant V21-1



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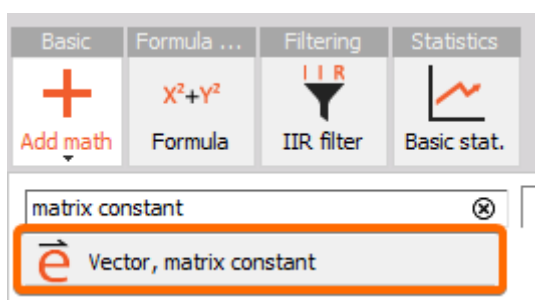
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2. Introduction

Arrays in DEWESoft can be in the form of vectors or matrices. This document describes how to define an array, present it on visual controls and how to use mathematics syntax on them.

3. Definition of vector/matrix

First, we will define a matrix channel in DEWESoft. Add a math called **Vector, matrix constant** under the Math section.



Manually enter a wanted Vector or a Matrix.

Output

Constant_1

Name: Constant_1

Description: -

Units: - Color:

Preview

Values X axis Y axis

Channels setup

Channels: Constant_1

Define values

Data structure: Matrix Data type: Single

Axis 0

Values count	Name	Unit	Axis type	Offset	Step
10	Axis 0	-	Offset/step	0	1

Axis 1

Values count	Name	Unit	Axis type	Offset	Step
4	Axis 1	-	Offset/step	0	1

Axis 0 (-)/Axis 1 (-)	0	1	2	3
0	1	0	0	0
1	0	2	0	0
2	0	0	3	0
3	0	0	0	4
4	0	0	5	0
5	0	6	0	0
6	7	0	0	0
7	0	8	0	0
8	0	0	9	0
9	0	0	0	10

Import/Export data

File Format: Clipboard

Copy Paste

4. Syntax and operations

Under **Math – Formula – Arrays** operations with vectors and matrices can be applied.

The screenshot displays the DEWESoft software interface. On the left, the 'Output' panel shows 'Formula 2' with a preview of a heatmap. The heatmap has 'Axis 1' on the horizontal axis (0,000 to 8,000) and 'Axis 0' on the vertical axis (0,000 to 10,000). The color scale ranges from 0,000 (blue) to 10,000 (red). The main 'Formula' editor shows the text `'Constant_1'`. Below the editor, there are sections for 'Basic operators' (+, -, x, /, (,), ^, div, mod) and 'Other math functions' (Functions, Trigon., Logic, Signals, Measure, Events, Complex, Arrays, History, Ch props). A table of functions is highlighted with an orange border:

[]	{ }	[0:len-1]	{0:1}
[, ,]	[:]	zeroes	ones
minind	maxind	minpos	maxpos
min	max	avg	sum
			integrate

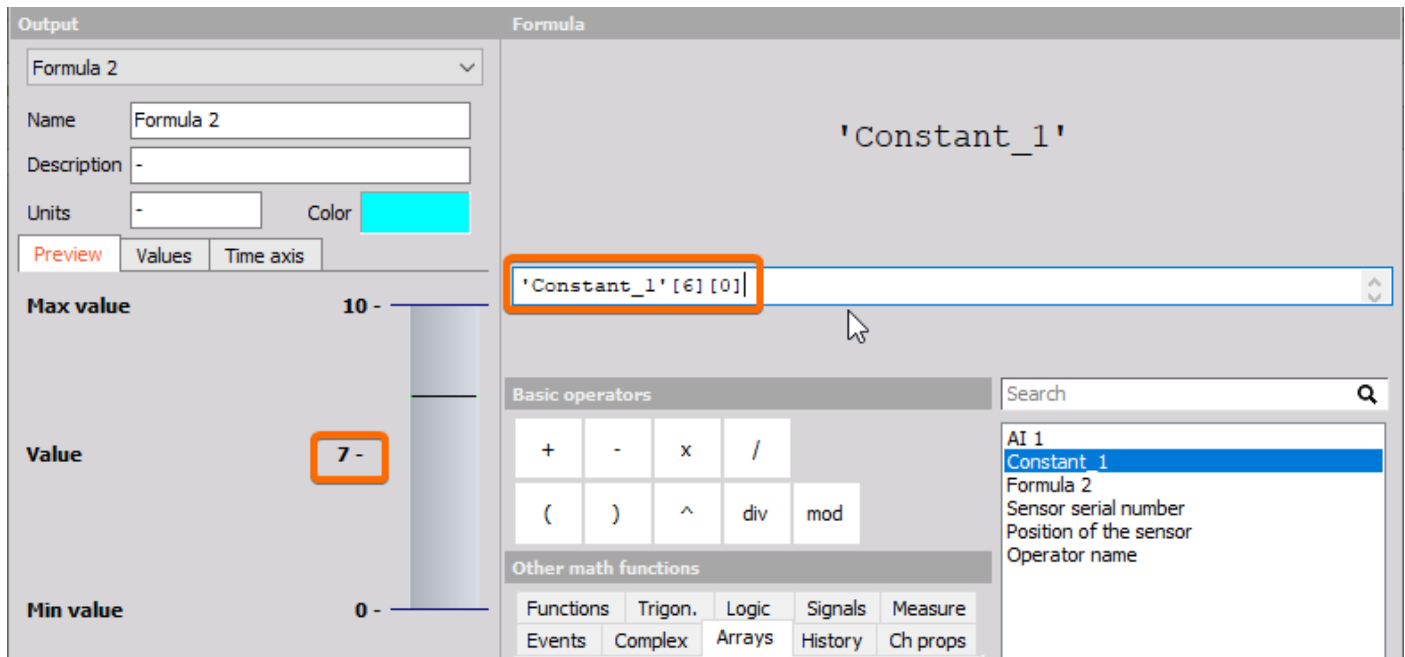
On the right, a search bar and a list of items are visible, including 'AI 1', 'Constant 1', 'Formula 2', 'Sensor serial number', 'Position of the sensor', and 'Operator name'.

Formula "Matrix Channel"[N][M] outputs elements from matrix in the position (M,N), where M and N are indexes (integer positions in array).

`'MatrixChannel' [N] [M]`

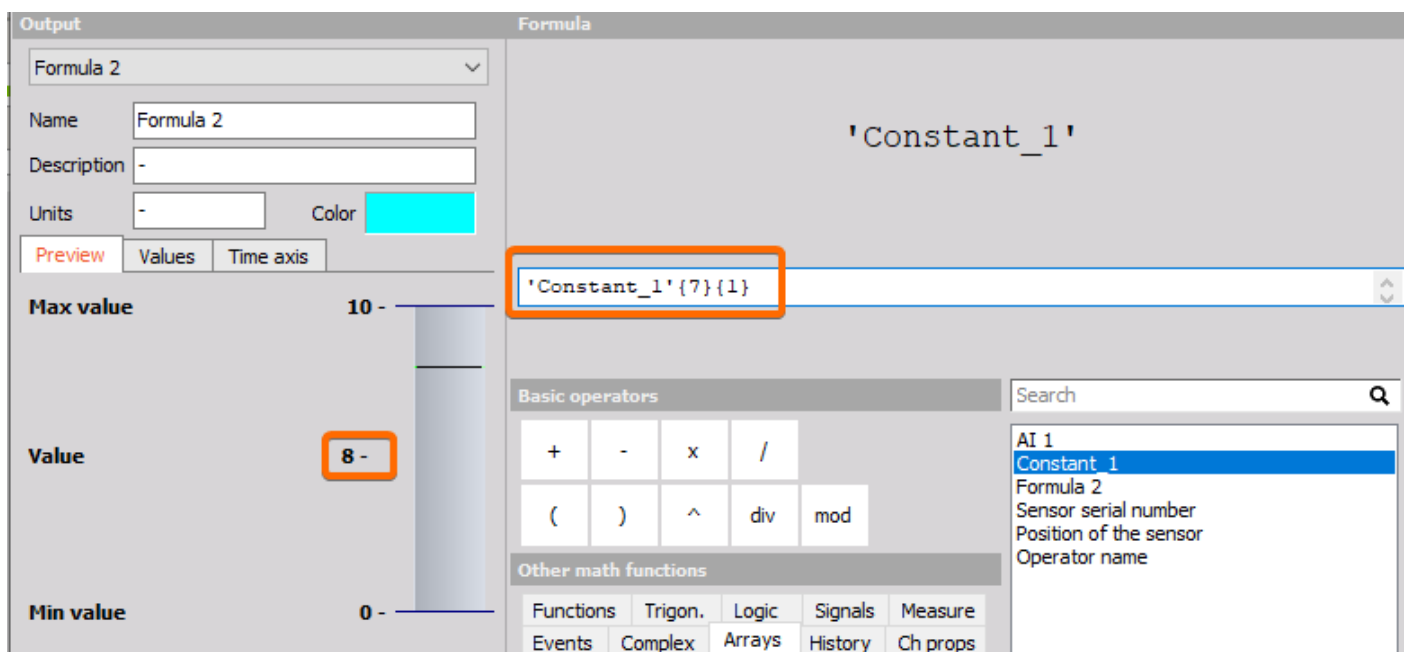


Note that syntax is not using standard (X,Y) notation but rather (Y,X) in this case. Reason is that array math interprets data like this!



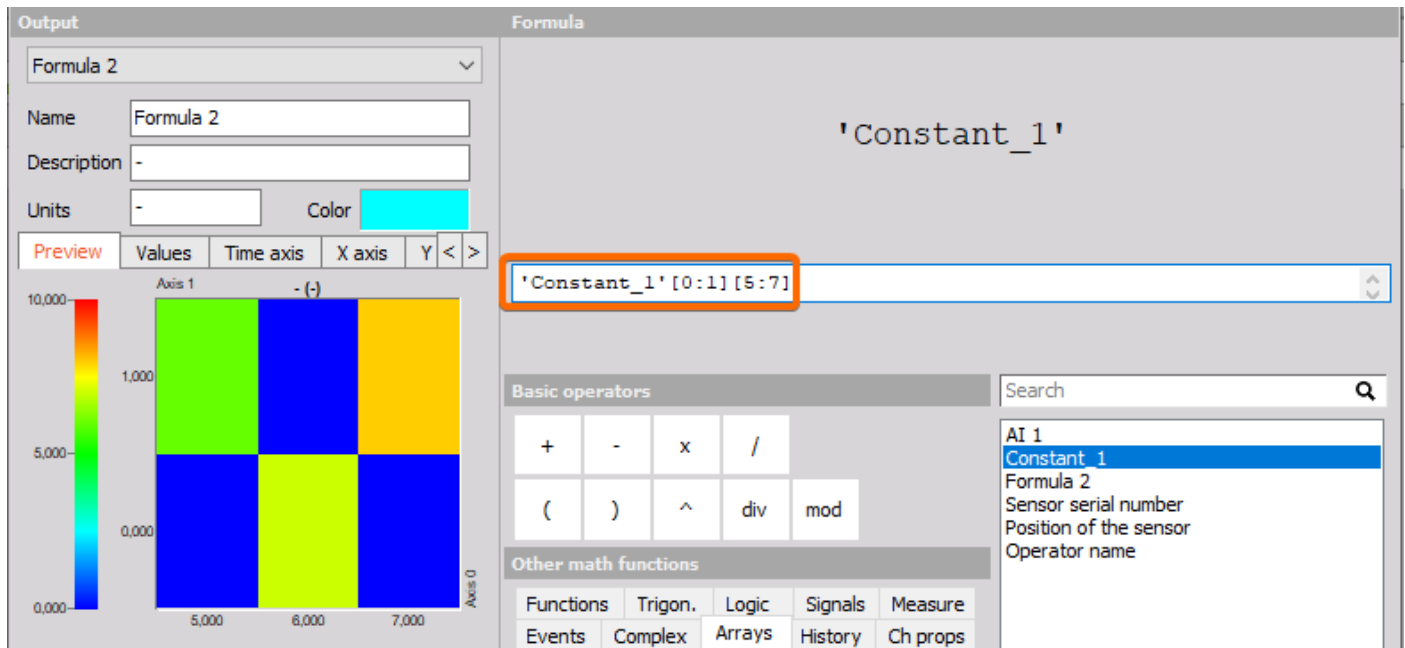
Formula “Matrix Channel”{N}{M} outputs element from matrix in the position (M,N), where M and N are in positions of axis units.

'MatrixChannel' {N} {M}

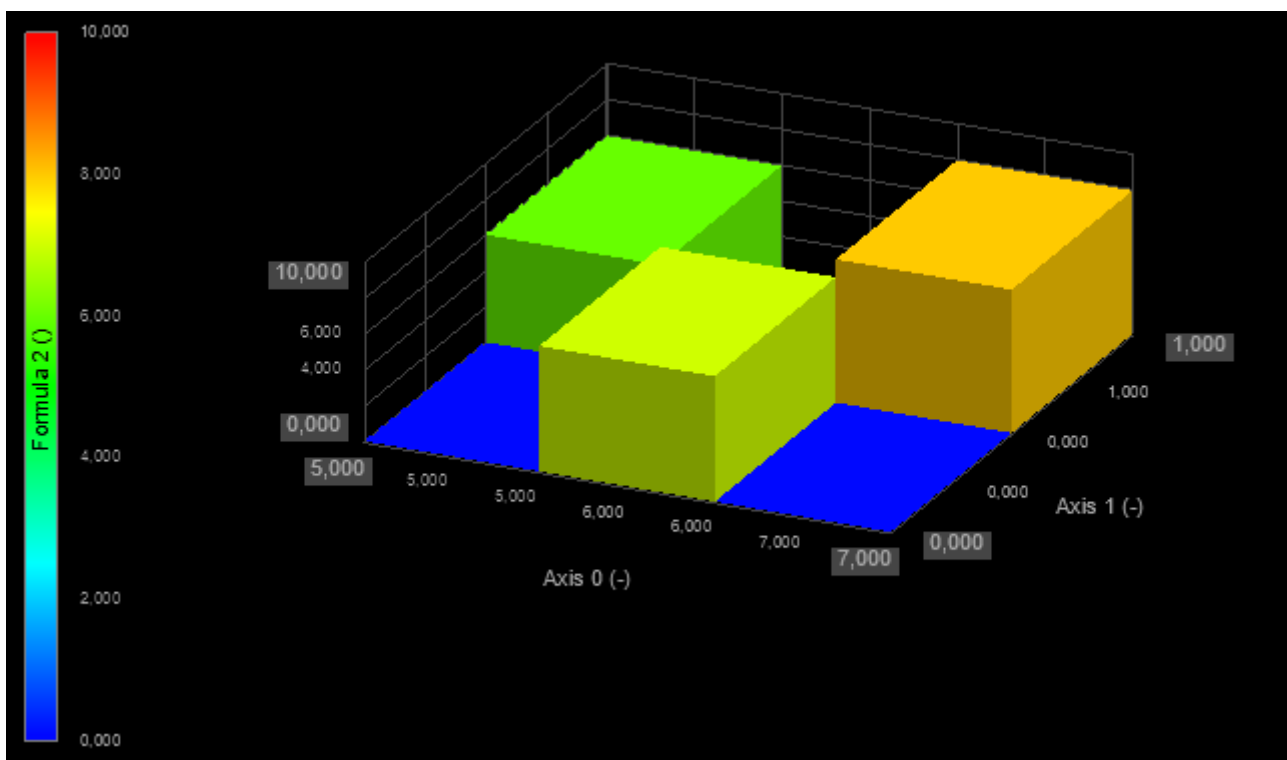


Formula “Matrix Channel” [N:Y][M:X] outputs matrix in defined X and Y intervals.

'MatrixChannel' [N:Y] [M:X]



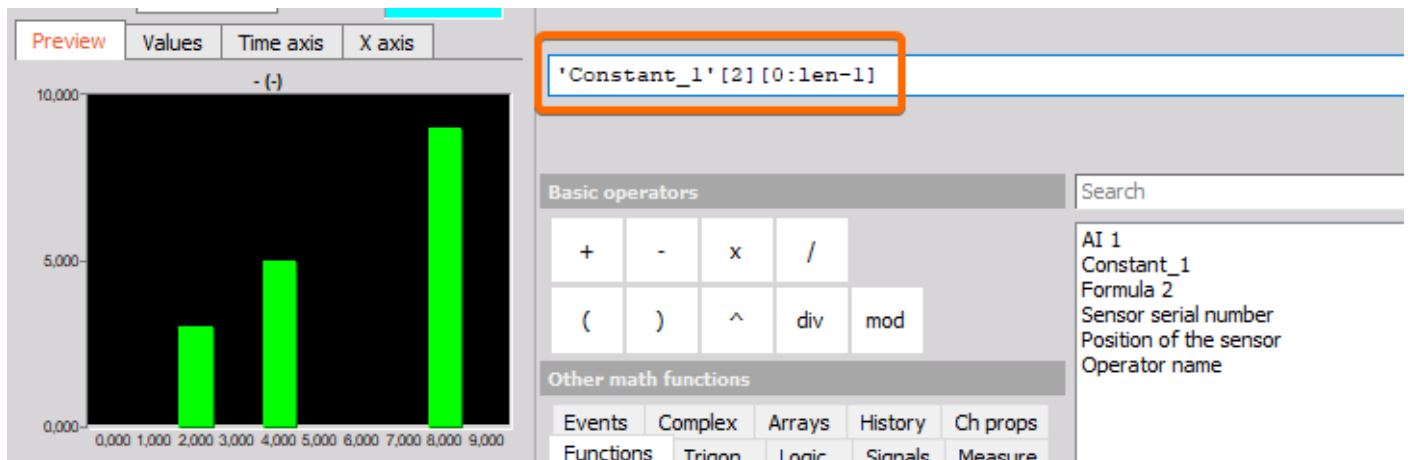
The result can be displayed on a 3D graph.



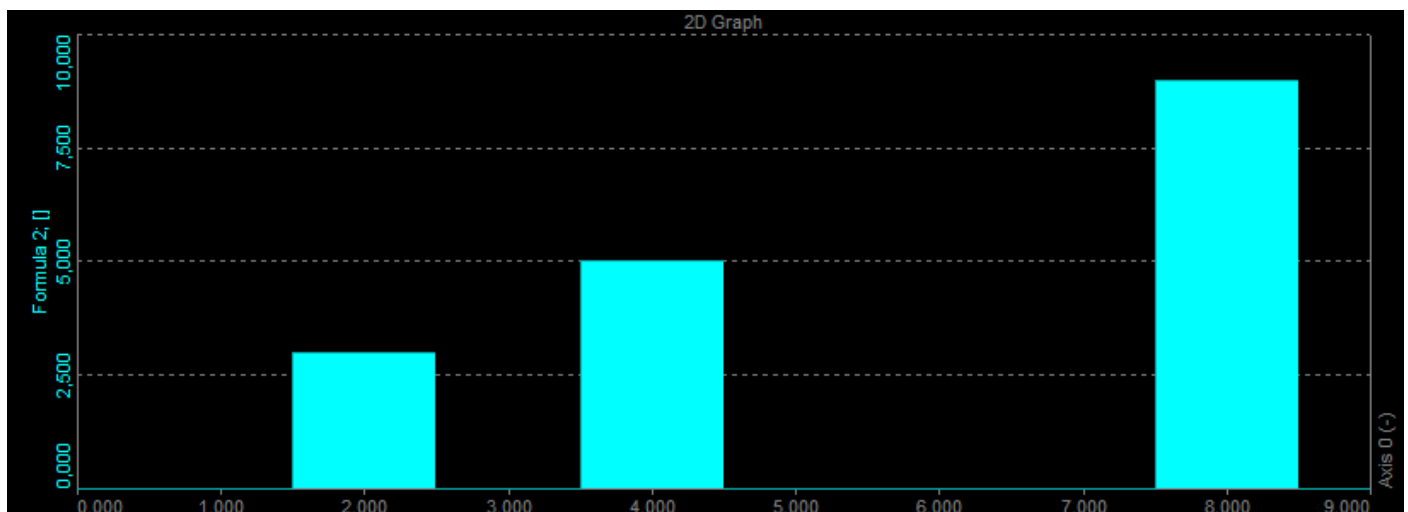
Same syntax logic can be used to output just one line from matrix, for example:

```
'MatrixChannel'[2][0:len-1]
```

Where **len-1** is a special tag indicating the last element.

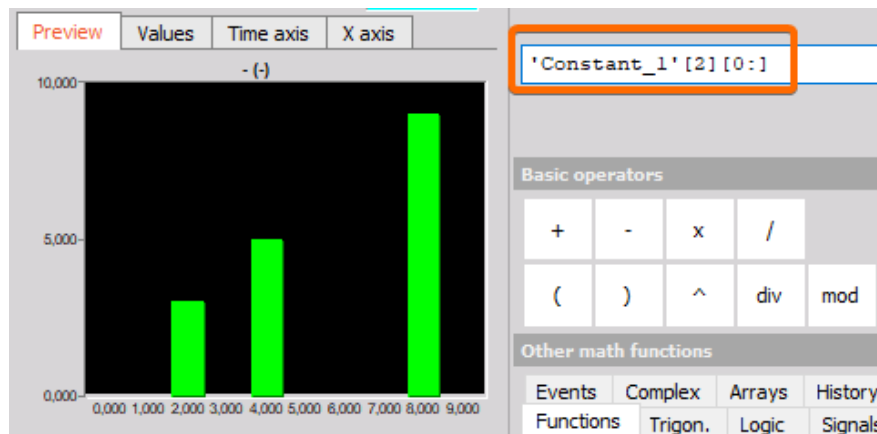


One line of matrix is displayed on a 2D graph:



The **len-1** tag can be also omitted, so that the syntax looks like this:

```
'MatrixChannel'[2][0:]
```



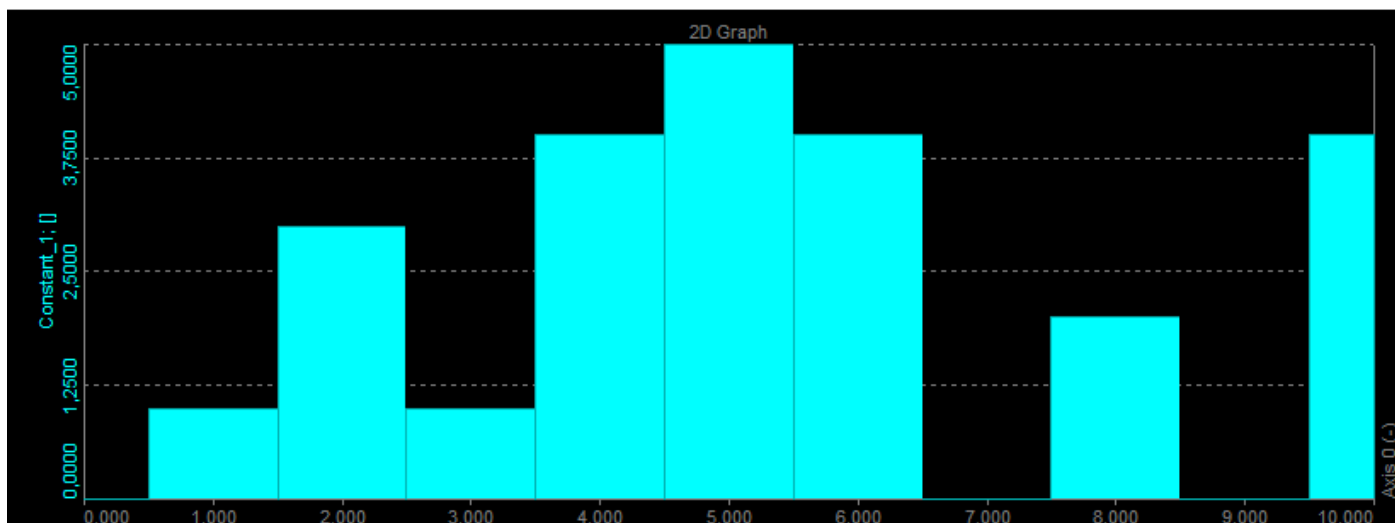
The syntax will output all elements in the third row (first row is zero) of our matrix.

The same logic also applies to vectors. Let's define a vector for this example.

The screenshot shows the DEWESoft interface with the 'Channels setup' tab selected. The 'Constant_1' channel is configured as a 'Vector' with a 'Data type' of 'Single'. The 'Axis 0' section shows a 'Values count' of 11, a 'Name' of 'Axis 0', a 'Unit' of '-', an 'Axis type' of 'Offset/step', an 'Offset' of 0, and a 'Step' of 1. A table below shows the values for 'Axis 0 (-)' and 'Value'.

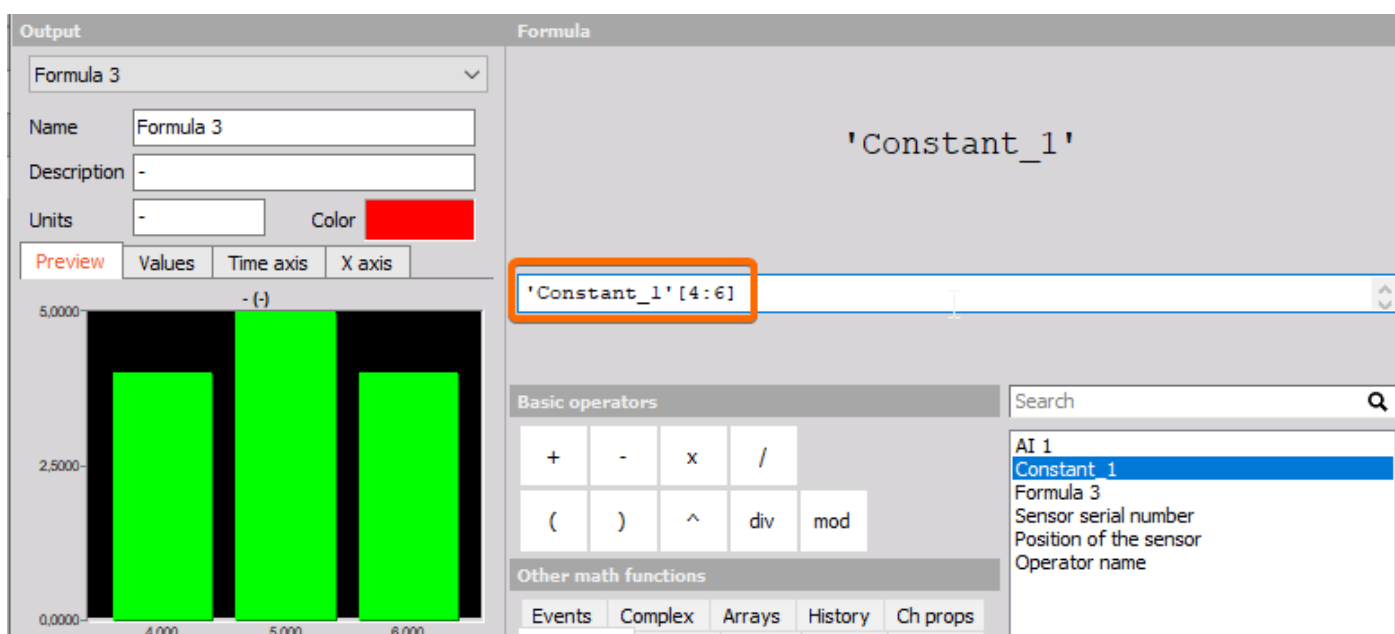
Axis 0 (-)	Value
0	0
1	1
2	3
3	1
4	4
5	5
6	4
7	0
8	2
9	0
10	4

Vectors are displayed on the 2D graph:



The formula “Vector Channel” [N:M] outputs the vector with elements from Nth to Mth element.

`'VectorChannel' [N:M]`



Output panel shows a preview of the formula result as a bar chart with three green bars. The Formula field contains `'Constant_1'`. Below it, a dropdown menu shows `'Constant_1' [4:6]` selected. The Basic operators and Other math functions panels are visible at the bottom.

Basically, all operations should work on arrays, but there are some limitations to it. We can for example do the following formula, where all elements in the array will be subtracted.

`'AI0/AmplFFT' - 'AI1/AmplFFT'`

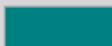
Output

Formula 6

Name Formula 6

Description -

Units -

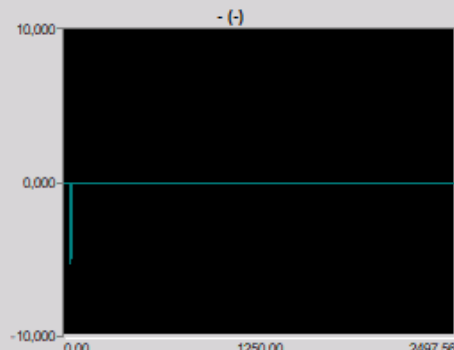
Color 

Preview

Values

Time axis

X axis



Formula

'FFTanalysis1/AI1/AmplFFT'-'FFTanalysis1/AI2/AmplFFT'

'FFT analysis 1/AI 1/AmplFFT'-'FFT analysis 1/AI 2/AmplFFT'

Basic operators

+

-

x

/

(

)

^

div

mod

Other math functions

Events

Complex

Arrays

History

Ch props

Functions

Trigon

Logic

Signals

Measure

Search

AI 1

AI 2

Constant_1

Formula 3

FFT block count

FFT analysis 1/AI 1/AmplFFT

FFT analysis 1/AI 2/AmplFFT

Formula 6

Sensor serial number

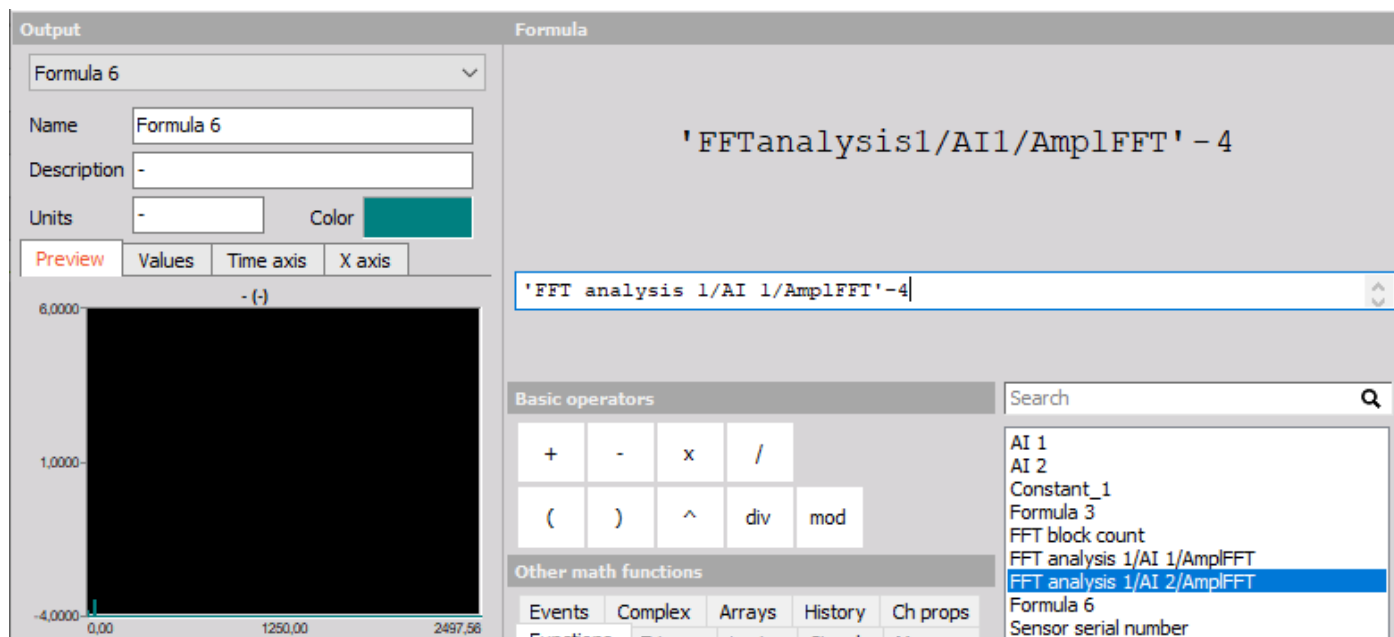


It is important to know that the product of two vectors just multiplies elements in the array! Same rule applies for matrices: DEWESoft math does not calculate “dot product” of two matrices! External applications should be used for that.

We can for example mix the vector and a scalar value:

'AI0/AmplFFT' + 2

This formula will add a value of two to each array element and will output array with the same sizes as the input:



The screenshot shows the DEWESoft software interface. On the left, the 'Output' panel displays 'Formula 6' with a name field set to 'Formula 6', a description field, and a units field. Below this is a 'Preview' section with tabs for 'Values', 'Time axis', and 'X axis'. The 'Values' tab is active, showing a graph with a y-axis ranging from -4,000 to 6,000 and an x-axis ranging from 0,00 to 2497,56. The graph shows a single data point at the origin (0,0).

On the right, the 'Formula' panel displays the formula $\text{'FFTanalysis1/AI1/AmplFFT' - 4}$. Below the formula field is a search bar and a list of available functions and variables. The 'Basic operators' section includes $+$, $-$, \times , $/$, $($, $)$, $^$, div , and mod . The 'Other math functions' section includes 'Events', 'Complex', 'Arrays', 'History', 'Ch props', 'Functions', 'Trigon', 'Logic', 'Single', and 'Measure'. The search results list includes 'AI 1', 'AI 2', 'Constant_1', 'Formula 3', 'FFT block count', 'FFT analysis 1/AI 1/AmplFFT', 'FFT analysis 1/AI 2/AmplFFT' (highlighted), 'Formula 6', and 'Sensor serial number'.

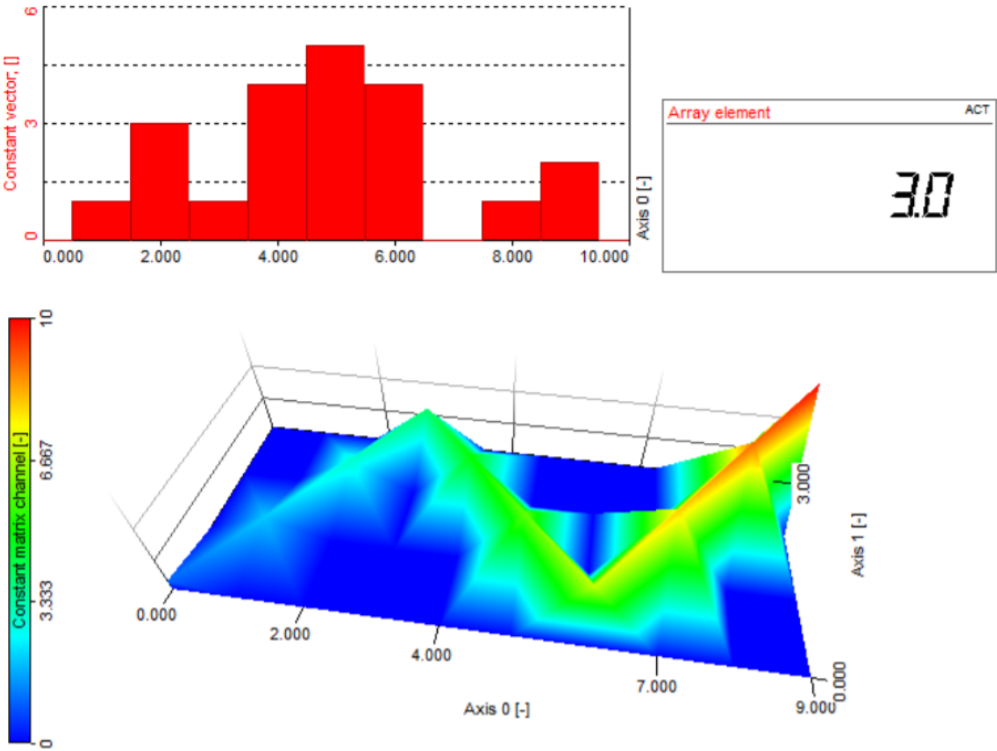


Important: arrays with different sizes cannot be combined into a single formula!

5. Visualization

In the Measure mode, while measuring, we chose **Design mode** and select visual controls that can present our calculated math channels.

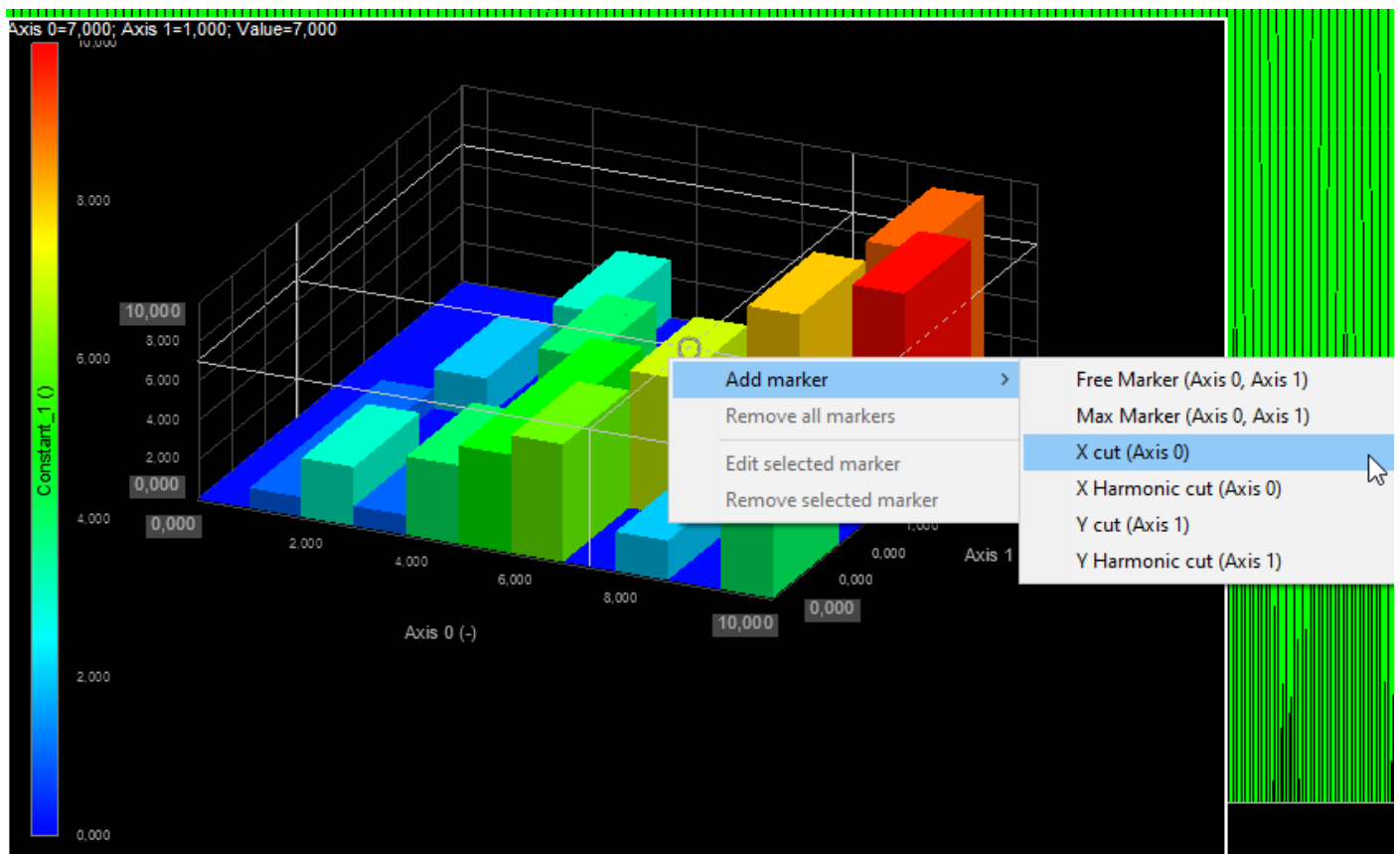
Our arrays can be presented on the 2D graph (vectors) and on the 3D graph (matrices). If we output only one element in an array, the number can be displayed on a digital meter.



5.1 X and Y cut

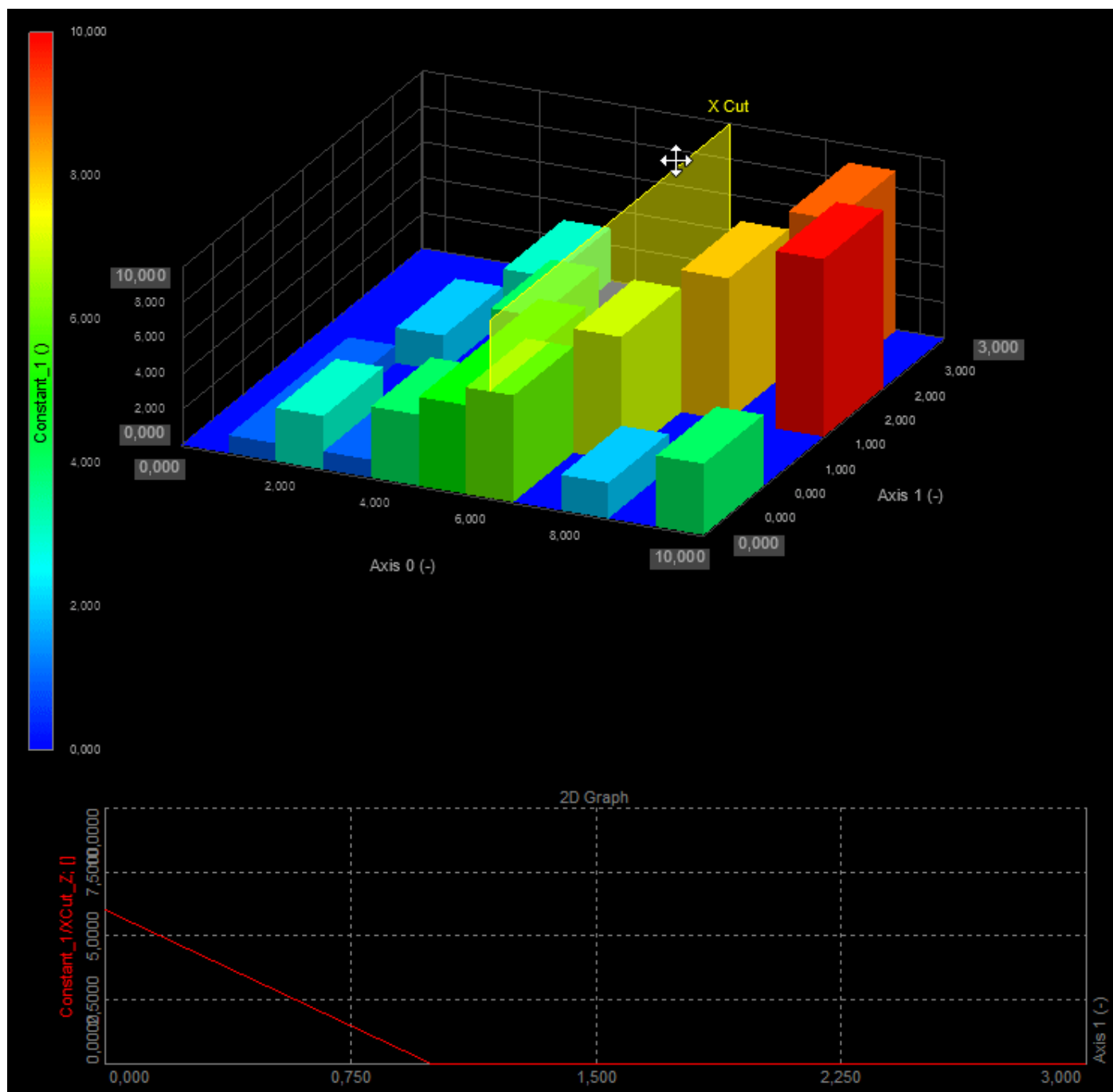
There is also a useful shortcut in DEWESoft that enables the visualization of X and Y slice of matrix, without the need of additional math channels:

1) Present your matrix on the 3D graph. Right click on the mouse and select to add X or Y cut.



Cut is displayed on the 3D graph and can be moved freely.

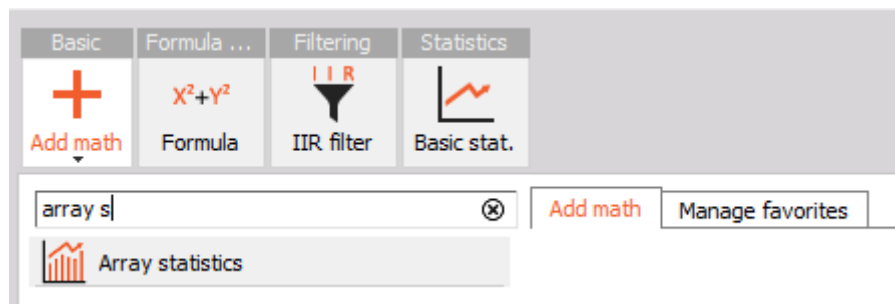
The result of the cut is displayed on 2 graph, as shown below.



The same procedure can be applied to the cut in Y direction.

6. Array statistics

The array statistics can calculate the statistical value from the array. It can be found among other math functions.



There are several options which can be chosen:

Input

Channels Slots

Search

- ☒ Constant 1
- ☐ Formula 3
- ☐ FFT analysis 1/AI 1/AmplFFT
- ☐ FFT analysis 1/AI 2/AmplFFT
- ☐ Formula 6

Output

Constant_1/MINAXIS

Name: Constant_1/MINAXIS

Description: -

Units: - Color:

Preview Values

Max value: 10 -

Value: -1 -

Min value: 0 - Min

Templates

<None> ...

Template is changed

Output channels

- ☒ Minimum
- ☒ Maximum
- ☒ Average
- ☒ Index of minimum
- ☒ Index of maximum
- ☒ Sum
- ☒ Axis position of minimum
- ☒ Axis position of maximum
- ☒ Variance

Array area

Selected area: ☒ Full ☐ Custom

Axis 0 bounds (index): 0 - 0

Axis 1 bounds (index): 0 - 0

Axis 1: - (-)

Axis 0: 0,000 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

10,000 3,000 2,000 1,000 0,000

0,000 5,000

Minimum	If finds the minimum value from the array
Index of minimum	It finds which index of the array holds the minimum value
Axis position of minimum	It finds which position in axis units holds the minimum
Maximum	If finds the maximum value from the array
Index position of maximum	It finds which index of the array holds the maximum value
Axis position of maximum	It finds which position in axis units holds the maximum
Average	Calculates average value of all elements from the array
Sum	Calculates sum of all elements from the array
Variance	Calculates the variance of all elements from the array

Legend

The following symbols and formats will be used throughout the document.



Important

It gives you important information about the subject.
Please read carefully!



Hint

It gives you a hint or provides additional information about a subject.



Example

Gives you an example of a specific subject.

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Support

Dewesoft has a team of people ready to assist you if you have any questions or any technical difficulties regarding the system. For any support please contact your local distributor first or Dewesoft directly.

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Email: Support@dewesoft.com

The telephone hotline is available Monday to Friday from 07:00 to 16:00 CET (GMT +1:00)

Service/repair

The team of Dewesoft also performs any kinds of repairs to your system to assure a safe and proper operation in the future. For information regarding service and repairs please contact your local distributor first or Dewesoft directly on <https://dewesoft.com/support/rma-service>.

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Documentation version history

Version	Date	Notes
2.0	12.1.2017	Initial version
V21-1	24.09.2021	Updated images, content